

PATENT COOPERATION TREATY

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REC'D 22 FEB 2006

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P 001 805 PC	FOR FURTHER ACTION	
See Form PCT/IPEA/416		
International application No. PCT/EP2004/002357	International filing date (day/month/year) 08.03.2004	Priority date (day/month/year) 08.03.2004
International Patent Classification (IPC) or national classification and IPC H04L12/28		
Applicant TELEFONAKTIEBOLAGET L. M. ERICSSON et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

3. This report is also accompanied by ANNEXES, comprising:

- sent to the applicant and to the International Bureau) a total of 9 sheets, as follows:
 - sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
 - sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
- (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

- Box No. I Basis of the opinion
- Box No. II Priority
- Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- Box No. IV Lack of unity of invention
- Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- Box No. VI Certain documents cited
- Box No. VII Certain defects in the international application
- Box No. VIII Certain observations on the international application

Date of submission of the demand 09.01.2006	Date of completion of this report 20.02.2006
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Isopescu, C Telephone No. +49 89 2399-7632



INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
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Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
 - This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
 - international search (under Rules 12.3 and 23.1(b))
 - publication of the international application (under Rule 12.4)
 - international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

Description, Pages

- | | |
|------------|--|
| 1, 2, 5-17 | as originally filed |
| 3, 4, 4a | received on 09.01.2006 with letter of 09.01.2006 |

Claims, Numbers

- | | |
|------|--|
| 1-15 | received on 09.01.2006 with letter of 09.01.2006 |
|------|--|

Drawings, Sheets

- | | |
|---------|--|
| 2/4-4/4 | as originally filed |
| 1/4 | received on 09.01.2006 with letter of 09.01.2006 |

- a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. The amendments have resulted in the cancellation of:
 - the description, pages
 - the claims, Nos. 16,17
 - the drawings, sheets/figs
 - the sequence listing (*specify*):
 - any table(s) related to sequence listing (*specify*):
4. This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
 - the description, pages
 - the claims, Nos.
 - the drawings, sheets/figs
 - the sequence listing (*specify*):
 - any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

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Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-15
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-15
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-15
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

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Reference is made to the following documents:

- D1: EP-A-1 207 708 (ERICSSON TELEFON AB L M) 22 May 2002 (2002-05-22)
D2: US 2002/019880 A1 (SAKAKURA TAKASHI) 14 February 2002 (2002-02-14)
D3: WO 99/48312 A (NOKIA MOBILE PHONES LTD ; LEMILAINEN JUSSI (FI)) 23 September 1999 (1999-09-23)

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. The present invention is to provide an unlicensed radio access network capable of locating a mobile station in response to a paging signal from the core network without undue signalling load.
This is achieved by an unlicensed radio access network according to claim 1, and two methods according to claims 11 and 14.
2. In the field of wireless technology, it is known that conventional cellular networks can be extended by adding access networks that utilise a low power unlicensed radio interface to communicate with mobile stations. These access networks are designed to be used together with the core elements of a standard public mobile network and consist essentially of plug-in low-power unlicensed radio transceivers, or access points, each designated to establish an unlicensed radio link with a mobile station and a controller or interface node connecting the unlicensed radio transceivers with the mobile core network. The access network is constructed so that the core elements, such as the mobile switching centers, of the public mobile network views the interface node as a conventional base station controller.
Document D1 discloses such an access network and the mobile station for use with said access network.
3. A main problem to such system is that due to the small size of the access point coverage areas and the ease with which it can be installed and moved means that each access point controller will be controlling a very large but frequently changing number of cells compared to the equivalent base station controller of a conventional

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cellular network. Consequently, when a mobile station roaming somewhere in the unlicensed radio access network must be paged by the core network, the signalling load on the access point controller will be very high due to the large number of cells and access points implicated.

4. The present invention solves the above mentioned problem by an unlicensed radio access network according to claim 1 and the methods according to claims 11 and 14.

According to the essential features of the invention the access controller is associated with one or more location areas in the licensed radio mobile cellular network and comprises a database for storing the identification of mobile stations in association with address information on the fixed broadband network which interconnect the access points with the access controller. The access controller is also adapted to delete the stored identification data when communication between the mobile station and the unlicensed radio access network ceases.

5. The present invention provides the advantage of an intermediate level of mobility management by the provision of the database for associating the identification of mobile stations with address information on the fixed broadband network. In this way the access network can actively direct messages from the core network towards a specific address, access point or group of access points to reduce the amount of signalling to and from the access points. Moreover, by permitting all registration and deletion of information to be controlled by the access controller the database is updated without the involvement of the core network.
6. The subject-matter of the present invention as claimed in respective independent claims 1, 11 and 14, in particular the feature of the access controller to update the stored identification data when communication between the mobile station and the unlicensed radio access network ceases, is neither disclosed in, nor rendered obvious by the prior art documents cited in the international search report, since: Document D1, which is considered as the closest prior art, relates to such an unlicensed access network, but is silent about updating the database when a mobile station ceases to communicate with the unlicensed radio access network. Document D2 teaches the dynamic allocation of IP addresses to wireless terminals

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connected to an IP network. A control center allocates IP address to a wireless terminal, for communication, based on an inquiry about the IP address of the terminal. The center transmits a failure message to an Internet terminal based on the inquiry, when the terminal is not detected.

Document D3 relates to a mobile station and mobile communication network which are connected via a LAN. A mobile station emulator is provided in a interface device of the LAN.

7. The subject-matter of independent claims 1, 11 and 14 therefore is considered to be new and to involve an inventive step, Article 33(2) and (3) PCT.
8. As claims 2-10, 12, 13 and 15 are dependent on respective independent claims 1, 11 and 14, said claims 2-10, 12, 13 and 15 do also meet the requirements of Article 33(2) and (3) PCT.
9. The present invention is susceptible of industrial application, Article 33(4) PCT.

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station controller of a conventional cellular network. Consequently when a mobile station roaming somewhere in the unlicensed radio access network must be paged by the core network, the signalling load on the access point controller will be very high due to the large number of cells and access points implicated.

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SUMMARY OF THE INVENTION

In the light of the above problems it is an object of the present invention to provide an unlicensed-radio access network capable of locating a mobile station in response to a paging signal from the core network without undue signalling load.

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This and further objects are achieved in an unlicensed-radio access network and method carried out in the same in accordance with the attached claims.

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Specifically, the unlicensed-radio access network is connected to a core network portion of a licensed mobile cellular network and includes an access controller connected to the core network and a fixed broadband network connected to the access controller and having a plurality of access points. Each access point defines a mini-cell coverage area and supports an unlicensed-radio interface permitting communication between mobile stations located within a respective mini-cell and the access controller. In accordance with the invention, the access controller is associated with one or more location areas in the licensed-radio mobile cellular network and comprises a database for storing the identification of mobile stations in association with address information on the fixed broadband network or at least one access point for each mobile station. The access controller is also adapted to delete the stored identification data when communication between the mobile station and the unlicensed radio access network ceases

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The provision of a database for associating the identification of the mobile station with a broadband network address or the access point via which the mobile station communicates with the access network essentially provides an intermediate level of mobility management. In this way the access network
5 can actively direct messages from the core network towards a specific address, access point or group of access points to reduce the amount of signalling to and from the access points. Moreover, by permitting all registration and deletion of information to be controlled by the access controller the database is updated without the involvement of the core network.,

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The access points may either comprise separate entities capable of establishing a connection with the access controller even when no mobile station is located in its coverage area, or they may be essentially transparent access points or nodes to the broadband network that simply relay messages between a mobile station and the access controller while providing the conversion between the unlicensed-radio interface and the fixed broadband network. In this latter case, the mobile stations will be assigned a network address on the broadband network, since the access points are not recognised as separate entities by the access controller.
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Preferably, the access controller is adapted to receive from the core network portion a paging message containing the identification of a mobile station located in the associated location area, to identify the network address or access point associated with the identified mobile station and to transmit the paging message to the identified access point or points only.
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In accordance with a preferred embodiment of the invention, the access network controller is adapted to receive from a mobile station a message registering identification data for the mobile station and to store the new identification data in the database in association with information concerning

an access point communicating with said mobile station. Similarly, the access controller is adapted to delete the identification data when the mobile station is no longer communicating with it. This may be on receipt of a message from

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Claims:

- 5 1. An unlicensed-radio access network connected to a core network portion (20) of a licensed mobile network, said unlicensed-radio access network (30) including an access controller (303) connected to said core network portion, a fixed broadband network (302) connected to said access controller and having a plurality of access points (301), each said access point defining a mini-cell coverage area (304) and supporting an unlicensed-radio interface permitting communication between mobile stations (1) located within a respective mini-cell and said access controller (303), characterised in that said access controller (303) is associated with one or more location areas in said licensed radio mobile network and comprises a database (3031) for storing the identification of mobile stations in association with address information of said mobile station on said fixed broadband network, said access controller (303) being adapted to delete said identification data when said mobile station ceases to operate in the coverage areas of said unlicensed radio access network.
- 10 2. An access network as claimed in claim 1, characterised in that said database (3031) is adapted to store the identification of mobile stations in association with at least one specific access point (301) for the coverage area in which said mobile station is located.
- 15 3. An access network as claimed in claim 1 or 2, characterised in that said access point controller (303) is adapted to receive from said core network portion (20) a paging message containing the identification of a mobile station (1) located in the associated location area, to identify the at least one access point (301) associated with said identified mobile station and to
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transmit said paging message to said identified at least one access point only.

4. An access network as claimed in any previous claim, characterised in that
5 said access network controller (303) is adapted to receive from a mobile station (1) a message registering identification data for said mobile station and to store said new identification data in said database in association with address information for said mobile station on said fixed broadband network (302).

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5. An access network as claimed in any previous claim, characterised in that said mobile station identification data is the international mobile subscriber identity (IMSI).

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6. An access network as claimed in any previous claim, characterised in that said address information is a network address of said access points (301) on said fixed broadband network (302).

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7. An access network as claimed in claim 6, characterised in that said address information relates identifies an access point (301) communicating with said mobile station.

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8. An access network as claimed in any previous claim, characterised in that said access controller (303) is adapted to delete said identification data on receipt of a message from said access point (301) that said mobile station (1) is no longer communicating with said access point.

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9. An access network as claimed in any one of claims 1 to 7, characterised in that said access network controller (303) is adapted to determine whether a connection with said mobile station is maintained and to delete said

identification data on determining that said connection is no longer maintained.

10. An access network as claimed in any one of claims 1 to 9, characterised in
5 that said database (3031) is adapted to store the identification of mobile stations in association with a group of access point (301) addresses, wherein said unlicensed access network comprises more than one group of access points.

10 11. A method in an unlicensed-radio access network comprising a plurality of access points (301) adapted to communicate with mobile stations (1) over an unlicensed-radio interface and an access controller (303) connected to said access points via a broadband network and to a core network portion of a licensed-radio cellular network, said method including the steps of:
15 receiving identification information specific to a mobile station from said mobile station,
registering said mobile station identification information in association with information identifying at least one access point in said access point controller, and
20 updating said registered information when communication between said mobile station and said unlicensed radio access network ceases.

12. A method as claimed in claim 11, further characterised by the steps of:
receiving in said access controller a message from said core network portion paging a mobile station,
25 retrieving information identifying at least one access point for said paged mobile, and
forwarding said paging message only to the at least one access point identified in association with said registered mobile station identification information.
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13. A method as claimed in any one of claims 11 or 12, characterised in that
said registering step includes registering said mobile station identification
information in association with information identifying a group of access
points in said access point controller.

14. A method in an unlicensed-radio access network comprising a fixed
broadband network with plurality of access points (301) and an access
controller (303) connected to said fixed broadband network and to a core
network portion of a licensed-radio cellular network and adapted to
communicate with mobile stations (1) over an unlicensed-radio interface
via said access points, said method including the steps of:

said access controller establishing communication with a mobile station
using a network address on said fixed broadband network for said mobile
station,

receiving identification information specific to a mobile station from said
mobile station,

registering said mobile station identification information in association
with said mobile station network address on said fixed broadband network,
determining when a connection established with said mobile station is no
longer maintained and deleting said mobile station identification
information when it is determined that a connection is no longer
maintained

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15. A method as claimed in claim 14, further characterised by the steps of:
receiving in said access controller a message from said core network
portion paging a mobile station,
retrieving mobile station identification information registered for said
paged mobile, and

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forwarding said paging message only to the network address identified in association with said registered mobile station identification information.

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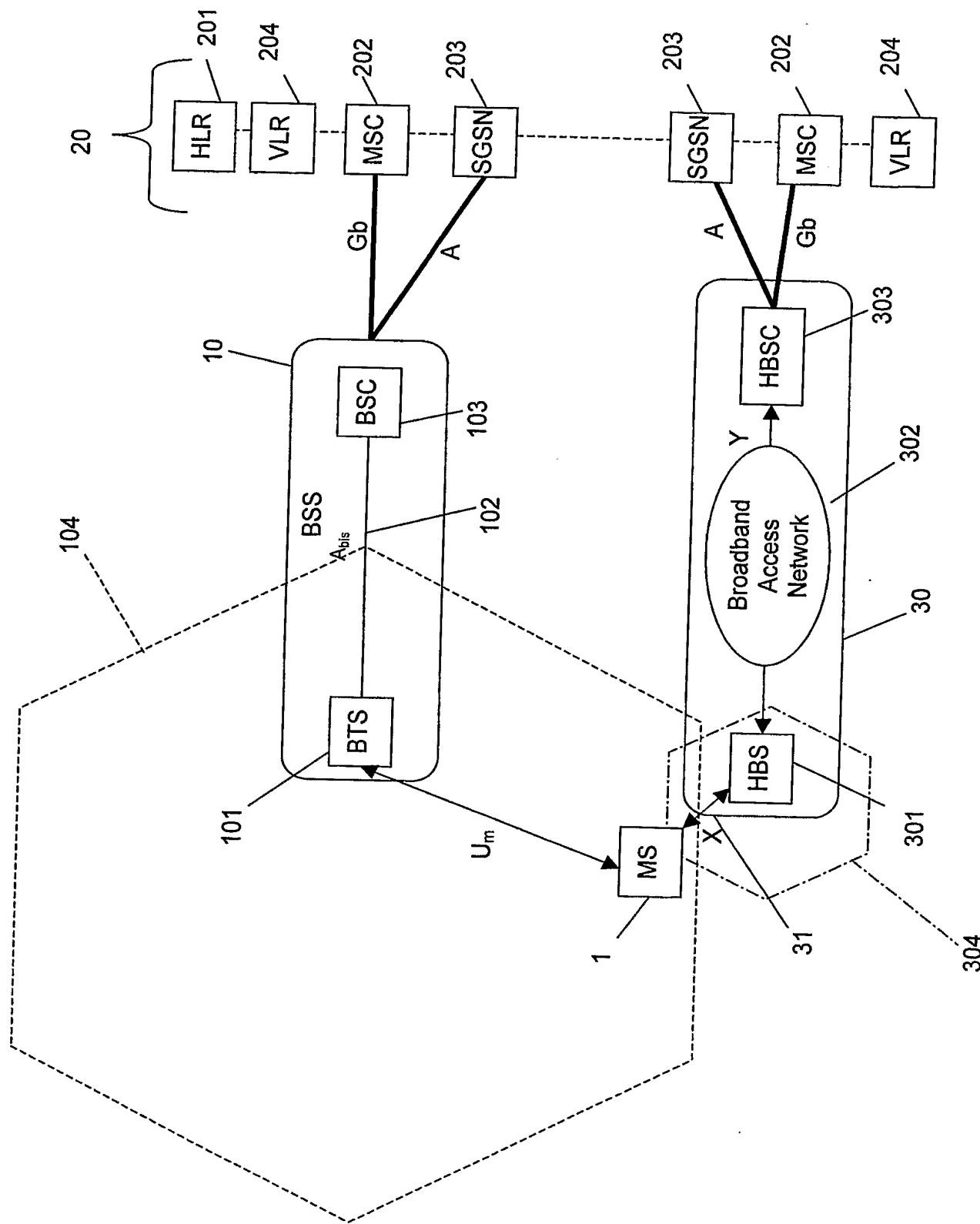


Fig. 1